WISIONS of sustainability

11

PREP

Promotion of Resource Efficiency Projects

Solar cooling – using the sun for climatisation

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WWW.WISIONS.NET

WISIONS
Sustainable Development is Possible

WISIONS is an initiative of the Wuppertal Institute for Climate, Environment and Energy, carried out with the support of the Swiss-based foundation Pro-Evolution, to foster practical and sustainable energy projects.

Sustainable development is possible. Numerous innovative and valuable contributions from different countries, fields and institutions have shown that an appropriate reconciliation of economic, ecological and social factors is not unrealistic utopia. We have made a promising start, but the greatest challenge still facing us in the 21st century is to learn how to use the world's resources more efficiently and in an ecologically sound and socially balanced way.

Progress is being made; however, fifteen years after the UN Conference on Environment and Development in Rio de Janeiro, many people, especially in developing countries, still lack access to resources, clean technologies, and education. At the same time, people's level of resource consumption and means of production remains unsustainable.

To meet global challenges like climate change, water scarcity and poverty, it is necessary to foster projects of potential strategic global importance by supporting them so that they can be implemented locally. Examples of good practice need to be actively promoted to a wider audience.

WISIONS promotes good practice in resource efficiency through its publication of relevant successful projects in its Promotion of Resource Efficiency Projects: **PREP**

WISIONS also provides consulting and support to ensure the potential seen in visions of renewable energy and energy efficiency can become mature projects through its Sustainable Energy Project Support: **SEPS**

Photo: photocase. de: sriesen.ch

SOLAR COOLING – USING THE SUN FOR CLIMATISATION

In recent years, the number of record-breaking hot summer days, especially in those regions with a usually moderate climate, has been increasing. This has led to a growing demand for climatisation in, for example, the workplace, and more and more office buildings are already being fitted with air conditioning systems. In many countries air conditioning is, however, one of the highest energy consuming services in buildings.

Conventional cooling technologies are generally based on electrically driven refrigerating machines. These have several disadvantages: they lead to high levels of primary energy consumption, cause high and expensive electricity peak loads and usually employ refrigerants with negative environmental impacts. This is where solar cooling comes into play. The sun, while heating up buildings, also delivers the energy to cool them. The major attraction of this system is that the hottest days have the greatest need for cooling and, simultaneously, offer the maximum possible solar energy gain.

Solar cooling systems have the advantage of using harmless working fluids such as water or solutions of certain salts; they are environmentally safe. Additionally, they can make huge energy savings in conventional energy of between 40% and 60% in chilled water systems. This, in turn, also reduces the pressure on electricity grids, which can sometimes reach their capacity limit on hot days.

In this brochure, **WISIONS** focuses on the applications of solar assisted cooling systems. After taking a more detailed look at the characteristics of such appliances, **WISIONS** presents projects in Spain, the USA, Germany and China that have been successfully implemented, with the intention of further promoting the particular approaches used by these projects. Using a key number of internationally accepted criteria, the main consideration for the selection of the projects was energy efficiency and successful performance. The assessment of the projects also included the consideration of regional factors acknowledging different needs and potentials.

Photo: photocase.de: Andreas Utsch – Yellow Tree

All projects that fulfilled **WISIONS** application criteria were independently reviewed, and 4 of them, with the potential to make a significant impact on global energy and resource efficiency, are published in the following pages. **WISIONS** is pleased to present good practice examples from ambitious projects that have been successfully implemented on different continents. All of these projects are appropriate within their local context and have been developed to a level which meets **WISIONS** selection criteria. Although uniquely designed for a particular setting and problem, the projects presented can be adapted to different situations or can provide valuable information from their implementation phase. Links to the illustrated good practice examples shown in the brochure are available on www.wisions.net.

The selected projects are not intended to represent the only possible course of action to take in the area of solar cooling but they do demonstrate promising approaches.

The next **PREP** brochure, following the same objectives, namely to collect, evaluate and promote good practice examples, will highlight the issue of "Water for Energy and Energy for Water".

What is solar cooling all about?

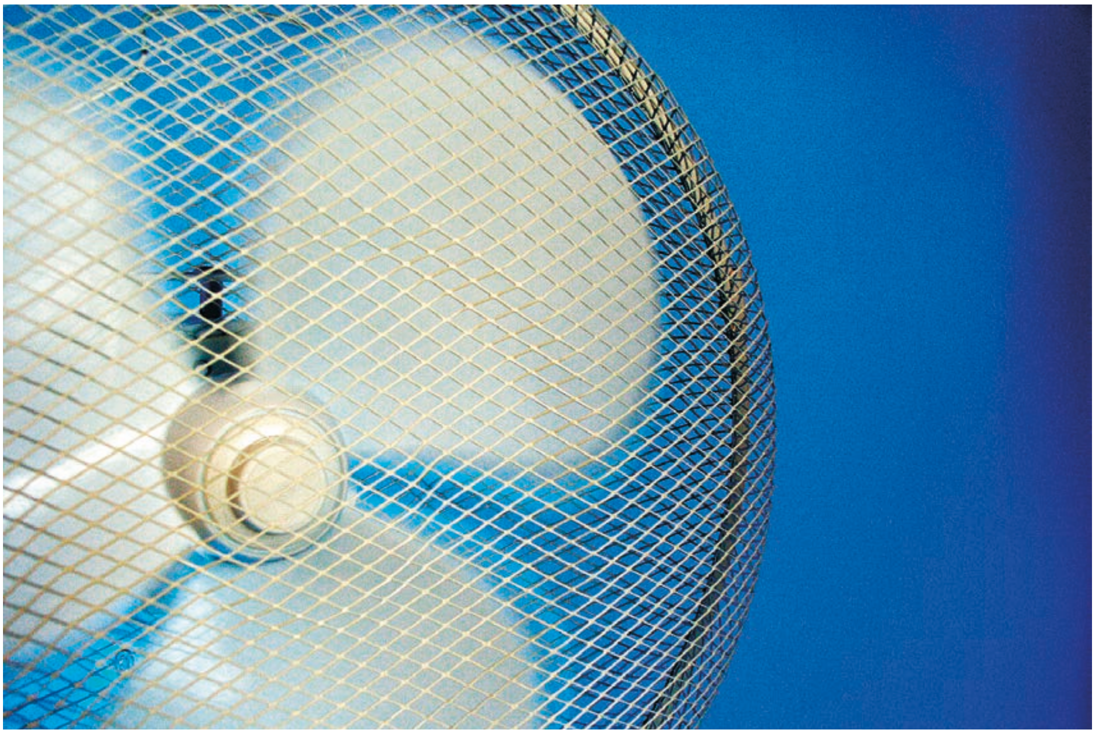


Photo: photocase.de: satzzeichen

Compared to other solar energy applications, solar cooling is a relatively new, but growing, technology. Many projects using the technology are still for the purposes of demonstration only, but a growing number of systems are being implemented all over the world for conventional use. In order to give an insight into this innovative technology, detailed information about the possible technical applications of solar cooling systems is provided in this section.

Passive solar cooling, based on bioclimatic strategies such as sun protection using natural screening devices or increased cooling by using ponds or water basins on the roof or close to the external walls, is widely applied and should be the first step to take in cooling a building. Such measures are easier and less costly to implement, they decrease the need for additional cooling and, therefore, for additional energy demand (and also for investment). Sufficient insulation of the building also decreases the need for cooling, as well as for heating.

If the outcome of these measures is not sufficient in itself, a solar assisted cooling system may be an intelligent solution. In solar assisted cooling systems solar heat is used to drive the cooling process for air conditioning in buildings. Instead of using electricity, free solar thermal energy is used for cooling through a thermal-chemical sorption process.

Benefits

The main benefit of solar cooling is that, in general, levels of solar radiation are highest when climatisation is most needed: the sunnier the day, the more energy is produced for cooling. As the application uses a renewable energy source it offers environmental benefits: a reduction in conventional energy use, as well as lower levels of harmful emissions.

Additionally, although a chemical process is adopted, the refrigerants that are used (water, salts, silica gel, lithium bromide and lithium chloride) are harmless and the chemicals do not come into contact with the air. Furthermore, as opposed those used in many electrically driven cooling systems, the materials used for solar cooling do not have a relevant global warming potential (GWP).

Another aspect, which is becoming increasingly relevant, is the lowering of demand on grid electricity in hot regions. The use of solar thermal energy reduces the need for electrical energy, especially at midday during summer, which is a peak time for electricity use.

The benefit for the user is in the reduced need for electricity, with a respective reduction in energy bills. In many Western countries the "peak load" electricity that can be partially substituted by solar driven systems is very expensive, while the solar energy itself is free. As energy costs are predicted to rise in the future, this cost aspect could become one of the most significant factors in the growth of solar cooling.

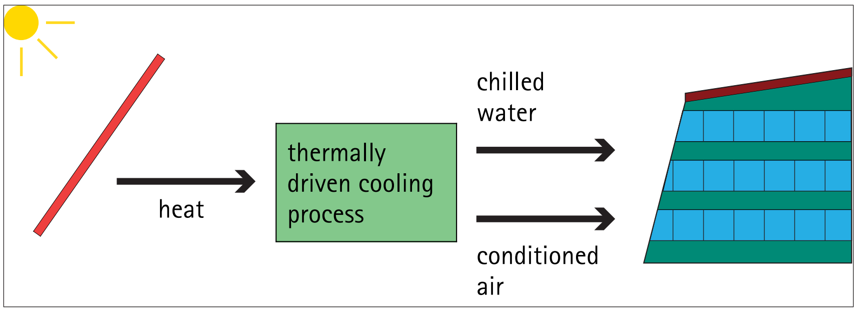
TECHNICAL ISSUES

Various technical solutions are possible, depending on factors such as the type of building, its function and the existing infrastructure. In principle, two different cooling technologies are available: closed cooling systems and open systems for dehumidification and/or cooling. In addition to using solar energy, both systems can also use waste heat from, for example, combined heat and power (CHP) plants to power or regenerate the system.

Closed cooling systems are based on the thermo-chemical process of sorption. A liquid or gaseous substance is either attached to a solid, porous material (adsorption) or is taken in by a liquid material (absorption). Globally, absorption chillers are the most widespread. A thermal compression of the refrigerant is achieved by using a liquid refrigerant or sorbent solution and a heat source. This process replaces the electricity consumption of a mechanical compressor.

Open or desiccant cooling systems, on the other hand, are able to reduce the humidity, which means that the air only seems to be cooler, yet comfort levels are significantly increased. Desiccant systems are often used in combination with evaporative cooling, leading to air dehumidification by a desiccant liquid or solid material. These systems are 'open' in the sense that the refrigerant is taken out of the system after having provided the cooling effect and is replaced by a new refrigerant in an open-ended loop. As there is direct contact with the atmosphere, the refrigerant is always water.

The technical performance of thermally driven chillers is given in COP, the thermal Coefficient Of Performance. It is defined as the fraction of heat discarded from the chilled water cycle ('delivered cold') and the required driving heat. Typical ranges of COP for closed cycles are 0.5 to 0.7 for adsorption chillers and 0.6 to 0.75 for absorption chillers. The COP range for open cycles typically lies between 0.5 and >1. The generated waste heat either has to be diverted to a re-cooling tower or is forwarded to a heat storage system; this could be, for example, a swimming pool where the waste heat is used for water heating.



Source: Hans-Martin Henning, Fraunhofer Institute ISE

To operate the solar assisted cooling systems, the solar thermal collector systems have to reach certain temperatures. For thermally driven chillers, the driving temperature is mainly between 60°C and 80°C, for desiccant cooling systems, the driving temperature is from 55°C to 90°C.

OBSTACLES

Although a large potential market for solar cooling exists, the current high investment costs present a significant barrier to broad implementation. Compared to conventional cooling systems, the upfront costs are around 2 to 2.5 times higher.

A solar assisted cooling system is quite a complex system, including solar collectors, the cooling device and the control technology. Therefore, ongoing technical maintenance is necessary and can present a challenge.

Most devices are still large scale, both in terms of their application and physical size. This makes adapting the technology problematic, especially for detached houses. However, smaller appliances are in development and some are already on the market.

REPLICABILITY

Despite the cost factors, it is accepted that there is great potential for solar cooling due to the basic benefits that it offers. Additionally, greater standardisation will, in time, result in cost reduction.

Any solar assisted cooling system has to be adapted to the local climatic conditions: in some regions dehumidification is of great importance and a desiccant cooling system might be the best alternative. In other regions where the cooling need is moderate, small adsorption or absorption systems might be sufficient.

Solar cooling of a detached house in Madrid

Location:
Madrid, Spain

Project's Aim:
Solar cooling and solar pool heating in a detached house

Technical Answer:
Development of a triple-state absorption system that allows decoupling from input and output

Project's Duration:
From February 2007, ongoing

Photo: ClimateWell

ClimateWell produces solar air conditioning adapted to the special needs of small appliances for single or multi (up to 5) family houses, as well as for hotels and offices. The solar cooling system is not a stand-alone technology but is integrated into solar heating to maximise its benefit. To date, ClimateWell has implemented this technology in over fifty homes, offices and public buildings.

The property used as an example in this project is a detached house in Madrid, built in the late 1980s. It was retrofitted in such a way to enable the use of solar energy for air conditioning, pool heating and for the provision of hot water during summer, while the same energy source provides energy for floor and water heating during the winter period.

Photo: ClimateWell

To achieve this, solar collectors, the solar cooling machine and a radiant floor for heating and cooling were installed. Using standard components to increase the cost effectiveness and replicability of the project, specialists in each field worked together to ensure the fine-tuning of the system. ClimateWell provided the chiller technology, Sun Technics contributed the solar energy knowledge and Uponor supplied the radiant floor system.

Benefits

The use of solar energy instead of conventional energy to run air conditioning offers several benefits.

On a global scale, the reduction in CO_2 emissions is the most significant advantage. Solar cooling systems offer high CO_2 saving potentials and, on average, up to 15 tons of CO_2 per year per system can be saved by using the technology applied in this project.

On a regional level, the increased use of solar energy for cooling lessens the demand on grid electricity and helps to avoid power failures during peak usage periods in the summer. Furthermore, the fact that solar energy systems do not depend on grid electricity allows for the development of solar projects in regions where the usage of grid electricity is at its maximum, or where there is no access to grid electricity.

For the detached house itself there are several benefits. Compared to a conventional system, the solar system runs silently creating no pollution and using no refrigerants. As the pool is used as a heat sink no extra cooling tower is necessary, which reduces the need for maintenance. In addition, the pool heating is free of charge because it simply uses the surplus energy from the solar system.

SUSTAINABILITY

The integrated character of the system allows for the conversion of all the solar energy that is collected daily throughout the year, thereby avoiding energy losses. During summer months the surplus energy that is generated by the absorption process is used to heat a pool and water for domestic use, as opposed to using a cooling tower as a heat sink where the surplus energy is not used at all. During wintertime the solar collector directly feeds the heating system, which significantly reduces the energy costs of conventional heating. Furthermore, the in-built energy storage capacity of the cooling machine makes it possible to bridge periods without sunshine so that the cooling or heating capacity of the system is not affected. Given the fact that the system's lifetime is predicted to exceed 15 years, the technology is highly sustainable.

TECHNOLOGY

The applied cooling technology is specific because the system is able to store energy and is, therefore, capable of decoupling the charging and cooling/heating process, which ensures a continuous supply of cooling or heating. This triple-phase absorption technology operates in three modes: charging, heating and cooling. Charging is achieved by means of a chemical process where energy is stored by the drying of lithium chloride (LiCl). By using LiCl, the absorption machine differs from other absorption chillers that use lithium bromide (LiBr), a chemical that is less sensitive to the low temperatures provided by solar thermal collectors. Other advantages are the two accumulators that work intermittently and are able to charge and discharge simultaneously because of their integrated storage capacity. Therefore, the configuration of the system allows high and stable electrical COPs (Coefficient of Performances; cooling or heating output (kW) divided by electrical input): 77 for cooling and 96 for heating.

FINANCIAL ISSUES

In comparison with a conventional air conditioning system the investment costs for the solar-powered system are twice as high, in the region of EUR 30,000. However, the monthly energy savings (EUR 117) are significantly higher than the monthly repayment costs (EUR 62 monthly repayment over 20 years at an interest rate of 4%), resulting in monthly savings of EUR 52, making the extra investment worthwhile. The balance looks even better if the cost savings for pool heating are included.

OBSTACLES

The main obstacles faced by the project were how to keep the investment costs low and how to simplify the system's composition to increase the attractiveness for small appliances e.g. detached houses. However, by using standardised appliances and exploiting the experience of earlier implementations, as well as collaborating with other experts, it was possible to overcome these obstacles while at the same time ensuring high quality and replicability.

Photo: ClimateWell

REPLICABILITY

As the whole system is configured to integrate standardised components, which are easy to distribute and the cost of which are likely to decrease, the replicability of the project is ensured. However, it is not only detached houses that are the target for replication – possibilities include hospitals in developing countries as well as supermarkets worldwide. In relation to the implementation of new energy solutions such as solar cooling, the public sector is regarded as an important and proactive customer providing the opportunity to apply this technology in hospitals, schools and offices.

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ClimateWell

DESERT OUTDOOR CENTER, ARIZONA

Location:
Lake Pleasant Regional Park, Arizona, USA

Project's Aim:
To provide a constant energy supply

Technical Answer:
Solar energy for heating and cooling the Center's buildings

Project's Duration:
April 2004 – April 2006

Photo: S.O.L.I.D.

The Desert Outdoor Center near Phoenix in Arizona, USA, offers educational and environmental outdoor programmes for students. The buildings of the Center are constructed with concrete and masonry to blend in with the surrounding landscape.

The Center is quite isolated and marks the end of an electricity grid. It is a challenge to provide the Center with a constant and sufficient supply of energy; therefore, the construction of a solar plant appeared to be a particularly appropriate solution.

The Center is equipped with a solar plant of 126m^2 high temperature (HT) collectors, designed by the Austrian company S.O.L.I.D. The solar energy is used for heating during the cold months and for running an absorption cooling machine for air conditioning during the hot months.

BENEFITS

Environmental benefits mainly consist of a decrease in conventional energy use and in a reduction of CO_2 emissions, as the absorption cooling system needs 20% less energy than a conventional electric chiller. In total, the electricity consumption of the whole Center has been reduced by about 20%, leading to energy cost savings. The life span of the absorption cooling machine is about twice as long as a conventional electric one, because there are nearly no defect-sensitive moving parts in the absorption machine.

The solar plant at the Desert Outdoor Center is a show-case one, providing valuable information about solar technology for the students. The whole system is placed in a compact, pre-fabricated "Energy Cabin". This cabin has a small window, through which the students can watch and understand how the system works.

As the solar cooling system does not use ventilators but only circulation pumps, the sound pressure level of the absorption machine is much lower than that of a conventional electric chiller.

The project was implemented in cooperation with local partners, who were trained in solar technology.

SUSTAINABILITY

The minimum expected lifetime for this project is 20 years, as this period constitutes the expected lifetime of the absorption chiller and the solar plant. The continuity of the project is assured because the operating company manages the solar power plant and has a maintenance contract with local companies. Therefore, the project's continuity is contractually and technically assured.

TECHNOLOGY

The whole building area amounts to 1,486m^2 and a heating and cooling system with electric chillers, a two-pipe system for alternate hot or chilled water, and fan coil units in each room was already present.

Photo: S.O.L.I.D.

Based on information about the existing circumstances, a 70kW cooling machine was designed. The system, including pumps, cold water storage and a control unit, is located in a container; the heat storage is situated beside the container and the cooling tower on the roof of the container.

The "Energy Cabin", which can be designed to any power specification, can be quickly and efficiently installed, commissioned and optimised for the particular application. For the operation of this "Energy Cabin" only the connection of two pipes and a bus bar is necessary. Because of the low number of interfaces the possibility of errors is limited.

The chiller used is not a typical compressor machine working with electrical energy, but is driven with thermal energy from the solar collector field or from the boilers. In this project an absorption chiller based on lithium bromide is used.

The total annual energy output of the solar plant is about 150MWh. The solar energy is used either for space heating in spring, autumn and winter, or for running the cooling machine in summer.

FINANCIAL ISSUES

The lifetime of the solar plant is about 20 years. Total costs amounted to about US$ 300,000 with an approximate payback period of between 5 and 7 years.

OBSTACLES

The main obstacles faced were at the outset of planning this project, including the search for customers, for operating partners with trust in this technology and for professional partners at the local level.

The major obstacles to implementing this technology are the high set-up costs involved. However, as knowledge about this technology increases and as plants such as these are constructed more frequently, both the cost and the time needed to design and implement the systems will decrease.

Photo: S.O.L.I.D.

REPLICABILITY

The basic principle of this solar plant is already used in other projects and other companies are interested in using the project's concept for their own applications. One aspect that is favourable for the replication potential is the fact that the transport and the installation of the solar plant is very easy because of the mobile plant room ("Energy Cabin").

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SOLID solarinstallation+design

Solar self-sufficient cooling in the office building of iba AG in Fürth

Location:
Fürth, Germany

Project's Aim:
Sustainable provision of adequate office climatisation during hot summer months

Technical Answer:
100 percent solar driven air conditioning based on absorption technology

Project's Duration:
September 2003 – August 2007

Photo: iba AG

During the extraordinary hot and long heat wave affecting Europe in 2003, parts of the iba AG office building reached over 40°C. The high temperatures not only affected the employees, but also led to computer failures. Passive cooling technology, such as window blinds, did not cool the building sufficiently; therefore air conditioning of the office building was recognised as a solution. Taking into consideration global warming and the need to reduce CO_2 emissions, iba AG was looking to use an innovative, clean and energy saving technology as an alternative to the energy intensive conventional air conditioning solutions available on the market.

Therefore iba AG decided to implement a solar self-sufficient air conditioning system in their office building. The grant programme "Solarthermie 2000plus", operated by the German Federal Ministry of Environment, Nature Protection and Reactor Safety (BMU), funded 50% of the investment costs and provided the basis for the launch of the project.

Benefits

The installation of the solar self-sufficient cooling system significantly decreases the operational costs for cooling and hot water provision. Additionally, the surplus heat is not only used for hot water supply or heating support, it also contributes to heating the neighbouring health spa.

The substitution of energy intensive air conditioning units also has the positive impact of reducing usage levels of conventional energy and, therefore, of lowering CO_2 emissions. However, the impact remains small unless other office and accommodation units convert to similar solar technology. This project shows that solar self-sufficient cooling in small and medium sized buildings can be a practical solution.

The applied technology improves the room climate in two ways. The rooms can now be kept suitably cool and the dry air effect of conventional systems is avoided by using absorption technology.

In addition to the environmental and indoor climate benefits, iba AG also benefited economically. The promotion of the project raised awareness of the implementing company and also opened up new market opportunities concerning the optimisation and evaluation of the control technology.

SUSTAINABILITY

Two months after the final implementation, the project demonstrated optimal performance in practice ensuring technological continuity and sustainability. As control engineering is one of the major competencies of iba AG and their own software and hardware is applied in this project, the company itself has a special interest in the longevity of the project.

TECHNOLOGY

The design of the solar plant is appropriate for a cooling capacity of 30kW. The recently developed absorption chiller Wegracal-SE30 enables the cooling demand to be met with flow temperatures below 75°C and is, therefore, well adapted to the capacity of the solar collectors. The solar panels and the refrigerant plant are connected via a 3,700 litre storage unit which delivers the energy for cooling and heating when needed. The absorption chiller, which uses lithium bromide, consists of two units - the evaporator-absorber and generator-condenser unit.

During the summer the absorption chiller works self-sufficiently, meaning that the solar fraction of the cooling process is 100%. Even though an external energy input is possible during periods with lower cooling yield, the project strives not to make use of this possibility, and consequently accepts that the cooling capacity decreases at certain periods. This strategy aims to reduce conventional energy input by only levelling temperature peaks, but still assuring a cooler room climate. Additionally, this approach avoids the problem that is often present in conventional air conditioning systems, where the difference between the inside and outside temperature is too great, which has a negative effect on the user.

During the winter when cooling is not necessary, the solar energy produced supports the hot water supply and heating system. The surplus energy gained during transitional periods is made available for the neighbouring health spa.

FINANCIAL ISSUES

The initial estimated investment costs, including the solar panels and their roof construction, absorption machine and piping system, the engineering of new control panels and integration of the system into the existing building automation, as well as the number of working hours for implementation amounted to around EUR 300,000. However, due to higher actual costs for construction material and labour the final investment costs increased by 25%.

OBSTACLES

The estimation of demanded refrigeration load was the first challenging step because the demand affects the capacity and engine performance of the installation. It was, therefore, important to neither over nor underestimate the cooling need.

The installation of the solar panels required an extra roof construction to meet static requirements. Furthermore, other modifications of the building were necessary to integrate the large components of the system into the building.

With the technical support and consultation from the project partners all obstacles were overcome. Partners included an engineering company, the Technical Universities of Ilmenau and Berlin, EAW and Solvis in supplying the absorption system and solar panels, architects and contractors concerned with hydraulic and technical solutions.

Photo: iba AG

REPLICABILITY

The concept and design of the installation could easily be transferred into other accommodation and office units, especially if the size of the components can be reduced. However, the best potential for replication is seen in the industrial sector, especially for companies discharging high amounts of rejected heat that could be used as the driving force for cooling.

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SOLAR-POWERED ADSORPTION COOLING SYSTEM IN A GREEN BUILDING IN SHANGHAI

Location:
Shanghai, China

Project's Aim:
Development of a minitype solar cooling system for public buildings and promotion of solar-powered integrated energy systems

Technical Answer:
Thermally driven adsorption chillers which meet a cooling demand of 15kW

Project's Duration:
September 2004 – August 2005

Photo: Shanghai Jiao Tong University

The solar-powered adsorption cooling system at the Shanghai Research Institute of Building Science is one of China's demonstration projects within the context of the green buildings campaign.

The aim of the project was to develop a small solar cooling system for public/residential buildings driven by solar energy derived from market-available solar collectors. As the cooling period occupies only a small period of the year and the energy input is more or less constant over the year, the system additionally includes three other functions: heating in winter, natural ventilation induced by solar hot water in spring and autumn, and hot water supply throughout the year.

The publicity derived from the project helped to achieve another of the project's aims, namely to promote the application of adsorption cooling technology in China.

Photo: Shanghai Jiao Tong University

BENEFITS

The solar fraction of the cooling system contributes about 72% of the cooling load during summer. When accounting for the effects of the integrated energy system, which includes floor and water heating, in excess of 60% of the annual building load is satisfied solely by solar energy. As a consequence, the yearly operating costs decreased by 54% compared to the conventional electricity driven system. The substitution of electricity through solar energy also results in a reduction of emissions, e.g. 60% less CO_2, 70% less SO_2, and 80% less NO_2. The adsorption chiller uses silica gel and water, which is environmentally friendly and avoids negative ecological side effects.

The local Commission of Construction mandated the project's experts to establish a specification to guide large-scale applications of solar integrated energy systems. Consequently some ideal integrated schemes have been implemented in residential buildings, where the residents have benefited from the positive impacts mentioned above.

SUSTAINABILITY

The team responsible for the project from Shanghai Jiao Tong University has more than 10 years of experience with solar-powered adsorption cooling technologies. The continuous and intensive collaboration with private companies has led to significant improvements concerning the technology and industrialisation, which has, in turn, ensured technological sustainability. Furthermore, the project is supported by the Shanghai Commission of Science and Technology, the Ministry of Science and Technology of China and the National Science Foundation Project, helping to assure the financial sustainability of the project.

TECHNOLOGY

The solar-powered adsorption cooling system consists of 150m^2 solar collectors satisfying the cooling and heating demand of 460m^2, and two adsorption chillers based on silica gel and water. In collaboration with the architects, u-type evacuated tubular solar collectors were attached to the building. A steel structure facilitates an adjustment of the collectors to face south with an angle of 40° allowing an optimal solar harvest.

The configuration of the adsorption chillers allows variations in flow temperature from 60°C to 90°C. Results of the first year of operation have shown that during summer the average refrigeration output of the system was 15.3kW, meeting the cooling demand. Maximum output of the system was 20kW.

FINANCIAL ISSUES

The investment costs of the solar-powered adsorption cooling system are about EUR 35,000; however, due to continuous improvements and standardisation, the project is making progress in decreasing the initial costs.

The results of the economic analysis show that the payback time is about 7 to 8 years, if based solely on heating and cooling. The payback time decreases to 2.5 years when the calculations include domestic hot water use.

OBSTACLES

Communication with stakeholders and service providers caused the main problems during the implementation process. To overcome this obstacle it was important to minimise the pressure put on other providers by supplying them with as much information as possible. The architects worked best when already provided with feasible schemes adjusted to the system's needs, e.g. area covered by collectors and their specific adjustment.

Concerning the integration of the solar energy system into the building's energy system, cooperation with the air conditioning designers was required. Therefore, the system should be designed to cover the cooling load of the considered area, eventually including potential back up systems.

REPLICABILITY

In China there are 7 solar-powered adsorption cooling systems in operation. The project can also be replicated in other areas. However, it is important that the system's configuration is designed by experts to ensure that the fine-tuning of the single components is performed to optimal level.

Furthermore, Shanghai Jiao Tong University is continually improving the structure of the adsorption chiller with efficient heat exchanger to reduce the size of the chiller. To improve the reliability of the chiller, a new circulation system, which reduces the number of valves, is under development.

Photo: Shanghai Jiao Tong University

Additionally, the system's configuration is being constantly improved to optimise the storage water tank, automatic control strategies and air conditioning terminal.

The continuing enhancement of the system will not only result in a decrease of initial investment costs, but also foster the further replication.

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上海交通大學

NEXT PREP TOPIC: WATER FOR ENERGY AND ENERGY FOR WATER

In 2004, WISIONS presented good practice examples on water and energy in its second brochure "Water and Energy – Precious Resources". Three years on, the topic is as important as it was then. For example, the current UN "Water for Life" Decade 2005–2015 stresses the importance of taking immediate action on water-related issues dealing with health, biodiversity, environment, agriculture and energy, as well as gender and the fulfilment of the Millennium Development Goals.

The urgency becomes clear when bearing in mind that, at present, 1.1 billion people in developing countries have no access to safe drinking water. Furthermore, 2.6 billion people lack access to basic sanitation. Around 70% of consumed surface or ground water is used for agricultural purposes. Moreover, withdrawals for land irrigation are estimated to grow by 14% between 2000 and 2030. Additionally, the agricultural sector is facing competition from other sectors that are also increasing their demand for water, forcing agriculture to improve irrigation efficiency, to decrease pollution and to use recycled water.

Above all, there is the connection between water and energy. Water, on the one hand, is a driving agent for renewable energy with great potential to improve the energy supply for people who lack reliable access to electricity or use inefficient energy sources. On the other hand, renewable energy can be a promising solution for the provision of drinking and/or usable water.

WATER FOR ENERGY

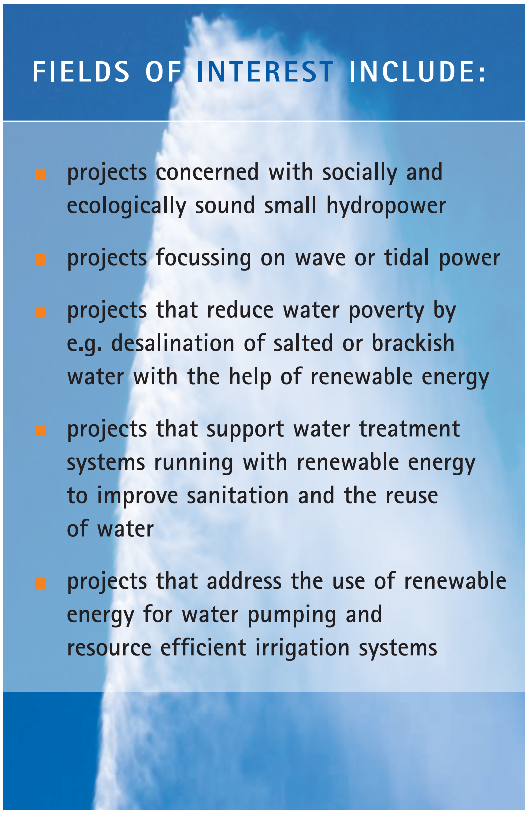
Small hydropower plants are a reliable supplier of electricity generation, especially for rural populations without access to grid electricity. Furthermore, in comparison to their larger counterparts, these plants are both environmentally and socially sound and can lead to independence from other energy providers.

More recent attempts to use water for energy generation are evident in the establishment of wave and tidal power plants. The kinetic and potential energy of the waves, derived from the wave's orbital movements and head difference between crest and trough, are converted into electrical energy.

ENERGY FOR WATER

Providing water of an optimal quality usually requires energy, for example groundwater pumping, desalination or irrigation. These activities are especially challenging in remote regions lacking access to conventional energy systems. In such circumstances, renewable energy, especially solar energy, can be a good alternative as it is a decentralised source of energy. However, regions with grid access can also take advantage of the use of renewable energy for the different kinds of water provision. For example, desalination of water is often needed in areas with high solar radiation and using the sun as a source for energy is a reliable solution which benefits the environment as well as the economic situation.

The "Water for Life" Decade aims to promote efforts to achieve international commitments made on water and water-related issues. In this context, WISIONS would like to renew its call for good practice examples on water and energy that help to fulfil the commitments and, to that end, invites the submission of examples of good practice.



FIELDS OF INTEREST INCLUDE:

- **projects concerned with socially and ecologically sound small hydropower**
- **projects focussing on wave or tidal power**
- **projects that reduce water poverty by e.g. desalination of salted or brackish water with the help of renewable energy**
- **projects that support water treatment systems running with renewable energy to improve sanitation and the reuse of water**
- **projects that address the use of renewable energy for water pumping and resource efficient irrigation systems**

SEPS – Sustainable Energy Project Support

To complement the promotion of good practices in the PREP brochures, WISIONS aims to bridge the gap between the existence of good concepts and their lack of implementation through the SEPS initiative.

The key objective of SEPS is to identify projects with the real potential to be of strategic importance in the renewable and efficient use of energy. By providing technical and other forms of support, SEPS seeks to overcome existing barriers, helping clean and efficient energy to become commonplace.

The most promising renewable and energy efficiency concepts are selected using transparent analysis based on internationally recognised criteria. The selection process is carried out via an annual call for applications (usually during the summer). Once a project is selected, SEPS can provide additional guidance and support, for example:

- potential financial support to assist with project implementation
- practical expert advice and knowledge transfer for effective implementation
- promotion to relevant institutions, decision makers and scientists
- publication on www.wisions.net

Projects supported must be innovative, sustainable and possible to replicate in other parts of the world. They have to be at an implementation ready stage and a well-developed implementation strategy must exist.

Examples of projects supported by SEPS

Sustainable Rural Energy Development, Peru (10 solar power systems and a pico hydro scheme)
In the Cajamarja region of Peru's highlands, "Soluciones Practicas" developed a rural electrification project for 10 communities. The main activities were in the field of technical and managerial capacity building, resulting in each community owning and operating the project on an economically sustainable model, based on a bottom-up implementation process. This project concept was allocated financial support in the second SEPS round. It started in spring 2006 and was successfully concluded in summer 2007.

Wind Power Electrification of the Island of Futuna
This project, which was started in spring 2007, is part of the third round of SEPS. In the short term it will install wind generators at schools and other institutions; longer term the viability of renewable energy technologies (RETs) will be demonstrated, which will support Vanuatu's ambitious policy aim of achieving 100% renewable energy. The special focus of VANREPA (Vanuatu Renewable Energy and Power Association) is on establishing a not-for-profit Renewable Energy Service Cooperative (RESCoop) that will provide the necessary technical and managerial support. The RESCoop will sell renewable energy to end-users and is considered to be an essential element for ensuring the sustainability of the project.

Criteria for obtaining SEPS support

SEPS has a set of criteria used in selecting appropriate sustainable projects and relevant forms of support. The following 5 criteria are obligatory:

- technical viability of the project
- economic feasibility
- local and global environmental benefits
- marketability and replication possibilities
- implementation strategy

Photo: VANREPA

As the goal of sustainable development requires an integrated approach, additional criteria are also applicable, such as:

- social aspects
- inclusion of local population/structures
- employment potential
- cooperation with other stakeholders

So far ...

In the first three calls, twenty-five projects were selected for financial support covering a broad array of innovative sustainable energy solutions in more than 16 countries.

In order to contribute to the implementation of more intelligent energy projects, WISIONS launched a fourth call for SEPS applications in summer 2007. On this occasion, over 180 project proposals from more than 50 countries were received, more than ever before. On completion of the selection process, a number of these ambitious projects will be implemented.

Further information about SEPS can be found on www.wisions.net/pages/SEPS.htm

Contact us:

More information about WISIONS, application criteria for PREP and SEPS, as well as prior PREP-issues are available at

www.wisions.net

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1	I. Issue 2004	Resource Efficient Construction
2	II. Issue 2004	Water and Energy – Precious Resources
3	I. Issue 2005	Sustainable Transport – Solutions for Growing Demand
4	II. Issue 2005	Sustainable Tourism – Combining Holidays with Local Needs
5	I. Issue 2006	Microfinance and Renewable Energy – Investing in a Sustainable Future
6	II. Issue 2006	Energy in Schools – Energy Education and Projects for Reducing Energy Demand in Schools
7	III. Issue 2006	Corporate Energy and Material Eficiency ... Makes Good Business Sense
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10	II. Issue 2007	Sustainable Energy for Poverty Reduction

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